Mathemania

An Honor's Thesis (Honrs 499)

by

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My honor's thesis provided the last piece to the puzzle so to speak of my educational career at Ball State University. Since I am a secondary mathematics teaching major, I created a project that utilizes many of the tools and techniques which I have learned throughout the course of my curriculum. I wanted to develop something that I could use in the classroom that will help students review and reinforce the topics that have been covered in the lectures.

My thesis project is a supplemental learning activity for three areas of the high school curriculum. The project's title is "Mathemania", and the three areas covered are Algebra I, General Math, and Geometry. I selected three games which correspond to each one--Algebra I- Variable Go Round, General Math--Tic-Tac-Toe, and Geometry-Jeopardy. Each of the games is complete with a game board, question cards, and an accompanying rules manual which is easy for students to follow.

The most difficult part of the project was coming up with an idea, but once that was determined, it was full speed ahead. Next, I decided to write the rules and regulations for each one as well as the equipment needed. The content in the question cards comes from state adopted text books that are used in high schools in these classes all over the state. The questions which were selected are from various difficulty levels to reinforce concepts, as well as challenge them to take on problems that they may have not seen before. I want the students to have to think and put the pencil to the paper to solve some of these. This way the students are doing more than just playing a game--the are learning mathematics! The project was completed using a Macintosh computer so all the information is contained on disk which allows me to add on or edit at any time in the future. The truly tedious part of the project was typing in all of the question cards. I did not mind it at all, but some of the question banks were rather large, so it took quite awhile to complete. On the other hand, my favorite part of the project was assembling the games and testing them to make sure that each one would be applicable to a classroom setting. This has been a semester-long project,

and seeing it completed brought me quite the feeling of relief and accomplishment at the same time.

I am anxious to use this in an actual classroom setting to see how it will work and what the students think. Learning takes place in all kinds of settings, and sometimes a little variety does wonders to motivate a student to want to investigate and discover things about a particular subject area. These games can be used as review mechanism before a test or as an alternative instructional technique on the day before break, the day of the big game, etc. The students will not only be challenged mathematically, but they will also have to develop strategies and use their critical thinking skills to complete the games successfully. I view this project as a possible way to show students that you can learn the skills of mathematics and have fun at the same time. My motivation in creating this project stems from the fact that I believe it is my job as an educator to vary the stimuli as well as the methods of instruction to provide students with a classroom environment that is conducive to learning, and at the same time; stress the point that there is much more to mathematics than pencil, paper, and calculator.

The games are structured in a way that will allow them to be used at more than one point throughout the course of a school year because the material covers a vast amount of topics that can be separated and applied to only the subjects that are being studied or put all together to provide a general review. The games can be played with small groups of students or even as an entire class where the teacher would act as the mediator and the game show host.

I would briefly like to describe each of the games and their purpose. The Variable-Go-Round for Algebra I is a cross between two of the popular television favorites, WHEEL OF FORTUNE and CONCENTRATION. It tests the students' knowledge of the basic computational concepts and then also asks them to identify some of the basic fundamental principles of Algebra by decoding the message.

Specifically, the student must solve a problem, and the correct answer rewards him/her with a designated number of points as well as a chance to decode the underlying message.

The Jeopardy Geometry game helps the students to recognize and identify the essential terminology and theorems that are necessary to understand this subject. In the first round of the game, the student must have a good working knowledge of the definitions and basic terminology in order to receive points for responding correctly. In the "double Jeopardy" round where it is double the points, the students must apply these terms and use them to be able to successfully complete the theorem that has been started on the front of the card. This game serves as an excellent review device particularly in the first part of the year when proofs are being completed. If the student does not know as well as understand the theorems, he/she will not have much success in completing the proofs. The questions in the Final Jeopardy round are relatively simple logic questions that the student must think about as well as use their reasoning skills to arrive at the solution. I selected these problems because working problems in geometry requires a student to think and then record the steps in a clear, logical sequence in order to obtain a correct solution.

The Tic-Tac-Toe game was created to sharpen the general math students' computational skills when working with whole numbers, decimals, and fractions. The question cards are of various levels of difficulty, and are labeled in the tray so that the student may select the card from the correct category that was drawn. Also, the answer is on the back of the card so the student can immediately check to see if the answer that was obtained was correct. This way, the students are working problems and are given the reward of their letter to place on the game board. Not only are they just executing the mathematical part, but they must also try to outsmart their opponent.

As I created the games and the rules it was important to apply things that I have learned about questioning as well as those about the nature of those students who will

be using these games. The questions should range in difficulty from easy exercises, to those which require a little more thought so that they will appeal to the majority of the students. I enjoyed working on the project, and I am looking forward to seeing what kind of value it will have in a classroom setting. I believe that it will be a useful tool to me in the future the can truly help my students to realize that they can all do well in mathematics if they put their minds to it. The students will follow the example set by the teacher, and it is my responsibility to demonstrate a positive and enthusiastic attitude towards mathematics as well as motivate them to want to learn. The key to unlocking the door to the students' world of mathematics is in the hands of the teacher; without it, they would wait and knock, but no one would arrive and answer the door.

RULES FOR JEOPARDY

MATERIALS: Game board, scorecards, bells to ring for the answer, timer

OBJECTIVE: To reinforce the basic concepts and ideas of geometry as well as to become a jeopardy master

The students will break up into small groups consisting of two to four members where they will use an arbitrary method i.e. the flip of a coin to determine who is to go first. The player who has the first turn maintains what is known as "control of the board." In other words, he/she has the choice of what category and how many points the correct answer would be worth.

This student would select the square to play for in the following manner: Simply, the contestant states the category and the number of points that he/she wishes to try. An example would be "Triangles for 200." Once a player has indicated which square should be revealed, that particular square is shown on the game board with the answer to a specific question. The students playing the game ring the bells to show they would like to try to give the question, and whoever rings in first gets the opportunity to do so. The player responds by using the "What is or what are" form.

Example: ANSWER: The baseball game(s) where the American League teams play

the National League teams.

QUESTION: What is the World Series?

If the player responds correctly, he/she receives the amount of points indicated by the board, and enters it promptly on the scorecard. (The players will tally their scores after each correct or incorrect response to maintain a running total.) This player would maintain control of the board and select another category where the procedure continues as mentioned above.

However, if the player that rang in first answers incorrectly, that number of points is subtracted from the total and the other players still have a opportunity to give the appropriate question. If another player responds with the correct reply, that player receives the number of points and gains control of the board where it becomes their choice to select the new category and number of points. The procedure for scoring is the same as mentioned previously. Yet, if the situation presents itself where all the players answer incorrectly or if no one answers; the control of the board stays with the person who selected the category, but no points are awarded nor deducted.

Play continues in this manner until the board has been cleared. The player with the most points is declared the winner of Round 1.

Round 2 is played in exactly the same way except all of the squares are played for double the points. Also, there are not specific categories, rather; this round is entitled COMPLETE THE THEOREM. As a player selects a square, the first part of a well known geometry theorem is revealed, and the first person to ring in has the opportunity to complete it. The rules for this round follow the same procedure as Round 1. Once the board is cleared, the round is over, and the person with the most points is the winner after two rounds.

The third and final round is called FINAL JEOPARDY. Before the players view

the final jeopardy problem, they must each indicate how many of their points they will wager. This amount must be at least one half of their present point total. The problem is revealed and the students are given the time to work on it individually. After the time has expired, the answer to the problem is given. Those students who are correct receive the number of points that they wagered added to their score, and those who did not come up with the correct answer have that number of points deducted from their total score.

WINNING THE GAME: The player with the most points after the final jeopardy round is declared the overall winner.

JEOPARDY SCORECARD

DIAGRAM OF JEOPARDY GAME BOARD

JEOPARDY

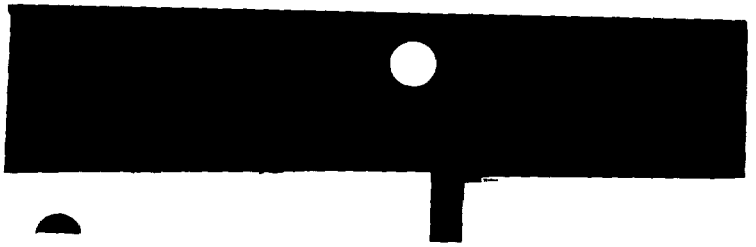
TITLE CARD	TITLE CARD	TITLE CARD	TITLE CARD
200	200	200	200
400	400	400	400
600	600	600	600
800	800	800	800
1000	1000	1000	1000

What is a line segment?

Behind each pant card is a question card and then a black card to place on that slot when the space has been used. (As the student removes the point card, the answer is revealed.)

For the second Jeopardy round, there are no title cards, and the students select the number of points. The first part of a theorem is revealed, and if the answer is correct, the player receives double the points.

An Example of each card:



400

POLYGONS

RULES FOR TIC-TAC-TOE

MATERIALS: Game board, letters, question bank

OBJECTIVE: To answer questions correctly in the area of general mathematics in order to place X's or O's on the board to get three in a row

The students will pair up and decide who will be X's and who will be O's. Next, they will use an arbitrary method such as the flip of a coin or the ever famous Paper, Rock and Scissor game to determine which player will go first.

The player who goes first will select a question card from the pile which has a label that indicates the category of the question that the player will attempt to answer correctly. Then, he/she will select a card in that particular category from the question bank. The player will attempt to answer the question correctly, and when he/she is finished, the individual will flip over the game card to check to see if the answer was correct. Remember, it is important to have answers in lowest terms or in simplest form in order for it to be counted correct. If so, that person has the right to place one of their letters on any space on the game board. Then, this player is allowed to select another question and follow the same procedure. The object is to get three in a row either up and down or diagonally. However, if this player answers the question incorrectly; their turn is over, and control goes to the opponent. Player number two selects a question

from the bank and follows the same procedure. The second player can place the letter in a space on the board that would thwart the opponent's attempt at three in a row.

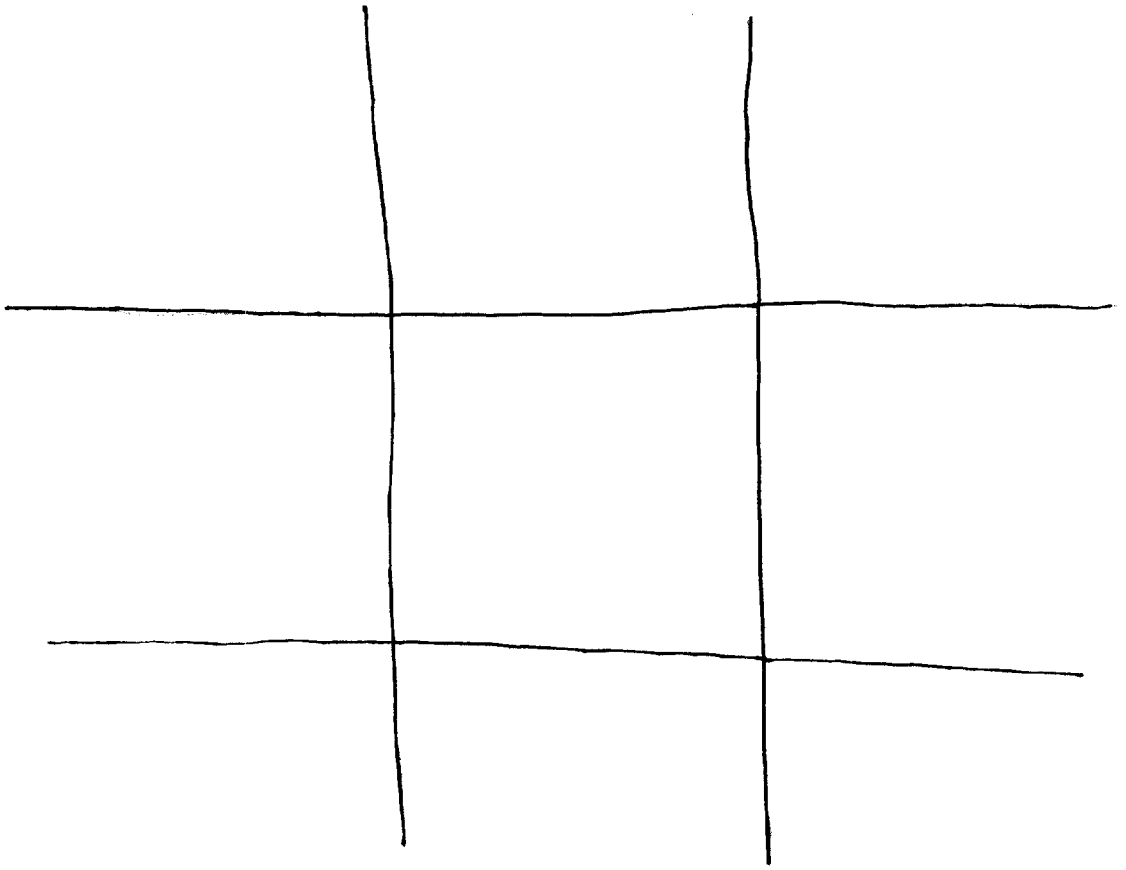
Play continues until one of the players gets three in a row commonly known as a Tic-Tac-Toe. This person receives one point and will put a one in the box marked game one on the scorecard. If the same player wins the second game the point total would double and a 2 would be placed on the scorecard under game two. As a player continues to win, the score will double each time so game three would be worth 4, and game four would be worth 8, and so on. However, if the other player wins, the point total would begin again at 1 and work its way up again. See the example below:

EXAMPLE:

GAME	1	2	3	4	5	6	7	8	9	10	
PLAYER 1	1	2	4			1		1	2		11
PLAYER 2				1	2		1			1	5

The points are tallied when the players have completed the number of games that time will allow, and the player with the highest point total is declared the overall winner.

TIC-TAC-TOE DIAGRAM



(GAME BOARDS ARE MADE OF WOOD)

SAMPLE TITLE CARD: ADDITION OF DECIMALS

SAMPLE GAME CARD: $4.783 + 1.829 + 5.318 + 2.175 + 9.384 =$

TOPICS COVERED IN THE GAME:

ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION OF

WHOLE NUMBERS, DECIMALS AND FRACTIONS

RULES FOR VARIABLE GO ROUND

MATERIALS: Spinner, game board, question cards

OBJECTIVE: To correctly solve algebraic equations to reveal pieces to a hidden puzzle and then state the answer to this puzzle

The students will be divided into groups that have three members. Two of the students will actually play the game where the other one will serve as the moderator. The students select for themselves who will play what role, and after each round the students will switch to give each other an equal opportunity to play the game. The moderator will ask the players to turn around and select as well as cover up the puzzle with the tiles provided. Next, the players each spin and the person who lands on the highest point total goes first.

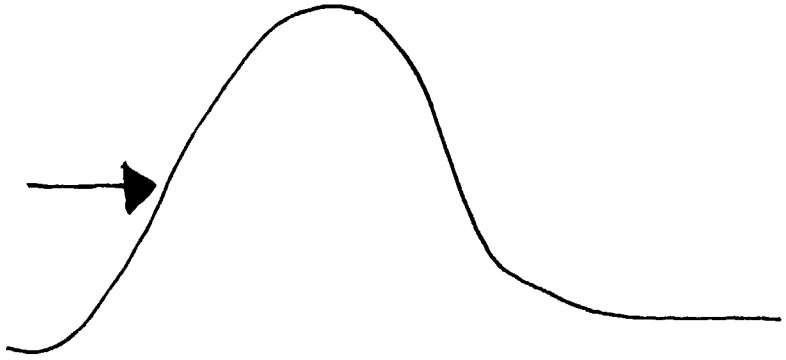
The first player spins and the number that comes up is the point value that the individual will receive if the problem is solved correctly. Now, the student selects a card at random from the bank and tries to solve it. If the question is answered correctly, the player receives the number of points indicated (records it on the score card) and has the right to remove any one of the tiles that covers the puzzle below. Now, this player encounters a couple of options. The first, is to take a guess at what the hidden puzzle says. If the guess is correct, then the game would be over, and if not, then control would pass to the other player. The second option is to not take a

guess at the puzzle and take another spin and try to earn another opportunity to remove yet another tile. All answers given are reviewed by the moderator and if there is any discrepancy, it is the moderator who will make the final decision as to whether or not the answer was satisfactory. However, if the question is answered incorrectly, then no points are awarded and the other player takes control and spins. This procedure continues until the tiles are all cleared, or until one of the players correctly solves the hidden puzzle. The player who solves the puzzle correctly receives 500 bonus points and the honor of being the moderator in the next game. If neither player is able to guess the hidden puzzle, no points are awarded, and the players will decide among themselves who will be the moderator for the next game. The player with the most points at the end is declared the winner of the game.

Players will be asked to turn around so that another puzzle can be selected and then covered up by the tiles. Play continues in the same manner. After time has run out, and no more rounds can be played, each player totals up the number of points in each of the previous games. The player with the highest cumulative total is the overall winner.

SCORECARD

EXAMPLE OF THE PUZZLE FOR VARIABLE-GO-ROUND



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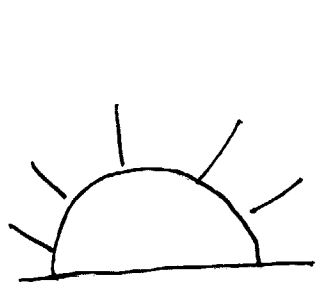

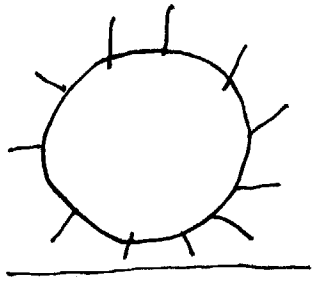

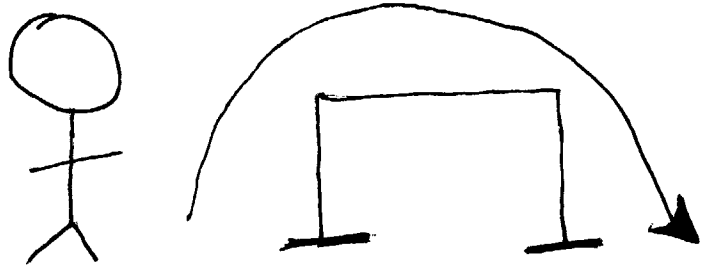

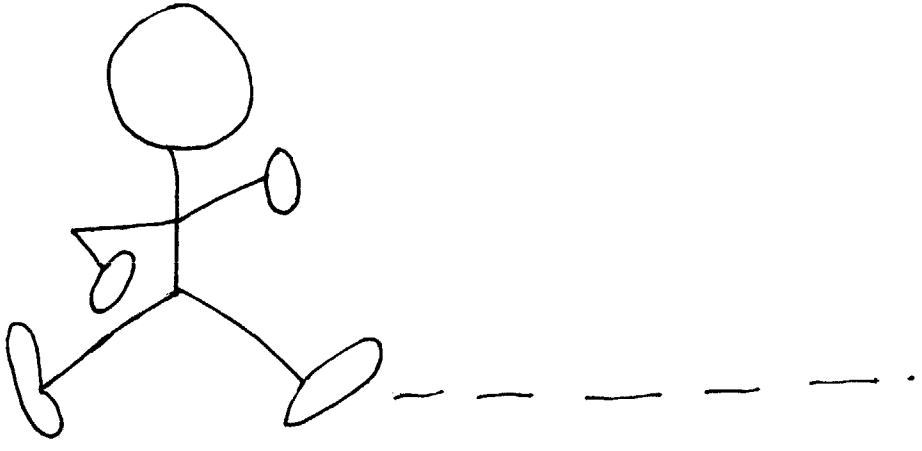

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** All textbooks used were adopted by the State of Indiana.